
2001 Vermont Guidelines for Energy Efficient Commercial Construction

State of Vermont, Amendments to the International Energy Conservation Code 2000

October, 2001



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Introduction

The Federal Energy Policy Act of 1992 (EPACT) directed states to adopt a statewide Commercial Building Energy Standard (CBES) based on ASHRAE/IESNA Standard 90.1-1989, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings. The Vermont Department of Public Service established the Commercial Building Energy Standards Working Group (CBES) in 1999 to develop a statewide commercial building energy code for Vermont. These Guidelines are the result of the CBES Working Group's ongoing effort to establish consistent, coordinated statewide minimum commercial building energy standards for Vermont. These Guidelines are fundamentally consistent with those adopted by the City of Burlington in November 2000 and they are designed to serve as a statewide commercial building energy code. The Department of Public Service, the CBES Working Group and the new statewide Energy Efficiency Utility support various jurisdictions and organizations in adopting the Commercial Guidelines and provide technical support and training throughout the state.

The CBES development and implementation project is funded in part through a grant from the U.S. Department of Energy.

These Guidelines adopt a nationally recognized standard, the 2000 International Energy Conservation Code (IECC) as the model energy code for the State of Vermont. This referenced standard is amended to suit Vermont's climate and special needs. Details of these amendments are provided in this document.

The intent of the Guidelines is to establish minimum energy use and application criteria. The Guidelines apply to all commercial construction as defined in IECC as amended herein.

The format of the Guidelines is designed to compliment the Vermont Fire Prevention and Building Code. The document references and amends the IECC 2000 and details administrative aspects of the guideline.

The following sections contain the amendments to IECC 2000. These amendments were developed to address issues that are specific to Vermont including:

- The administration of the Guidelines through the Vermont Department of Public Service (DPS),
- Climate conditions specific to Vermont,
- Amended building envelope requirements,
- Bringing the stringency of the IECC in line with ASHRAE/IESNA Standard 90.1-1999, and
- Additional Vermont Amendments, not found in IECC, on:
 - Electric motor efficiency levels,
 - Power system and transformer criteria,
 - Limitations on the use of electric resistance space heating,
 - Under slab insulation levels,
 - Kitchen exhaust hood makeup air requirements,
 - Exterior lighting illuminance levels and
 - Design and acceptance documentation.

For Assistance:

For assistance with the commercial construction requirements of the 2001 Guidelines please call the Vermont Department of Public Service at 1-800-642-3281 (in-state) or 1-802-828-2811

For the Burlington Electric Department please call 1-802-865-7342.

For Vermont Gas please call 1-802-863-4511

For Efficiency Vermont please call 1-888-921-5990

Sources:

To order a copy of **International Energy Conservation Code 2000**, Copyright 1999, International Code Council, Inc., First Printing contact:

Southern Building Code Congress International, Inc.

900 Montclair Road
Birmingham, AL 35213-1206
(205)-591-1853
E-mail: info@sbcc.org
Web site: www.sbcc.org

or

Building Officials and Code Administrators (BOCA) International, Inc.

4051 W. Flossmoor Road
Country Club Hills, IL. 60478-5795
1-800-214-4321, ext. 777
Web site: www.bocai.org

or

International Conference of Building Officials (ICBO)

335 Ridgepoint Drive
Carmel, Indiana 46032
1-800-284-4406
Web site: www.icbo.org

To order a copy of **ASHRAE/IESNA Standard 90.1-1999, Energy Standard for Buildings Except Low-Rise Residential Buildings**, Copyright 1999, American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. contact:

ASHRAE Customer Service
1791 Tullie Circle, NE
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Web site: www.ashrae.org

Chapter 1: Administration and Enforcement

101 – SCOPE AND GENERAL REQUIREMENTS

Revise Section 101.1: Title

101.1 Title. This code shall be known as the 2001 Vermont Guidelines for Energy Efficient Commercial Construction ~~International Energy Conservation Code~~ of the State of Vermont [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as “this code.”

Revise Section 101.2: Intent

101.2 Intent. The provisions of this code shall regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in ~~new building~~ new commercial construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This code is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

Revise Section 101.3 Compliance

101.3. Compliance. Compliance with this code shall be determined in accordance with Sections 101.3.1. and ~~101.3.2.~~

Delete Section 101.3.1: Residential Building Compliance

Note: all residential buildings of Type A-1 and/or Type A-2 (detached one and two family dwellings and multi-family dwellings of 3 stories or less in height) shall comply with Sec. 21 V.S.A. § 266, the Residential Building Energy Standards (RBES).

Revise Section 101.3.2: Commercial Buildings

101.3.21 Commercial Buildings. For commercial buildings, a prescriptive, system or energy cost budget approach (Chapter 7) or as specified by acceptable practice (Chapter 8). Documents relating to the proposed construction, which contain information necessary to verify compliance with this code, such as calculations, worksheets, compliance forms, vendor literature, or other documents, shall be made available when requested by the code official to permit an evaluation of such documents. Compliance with specific provisions of this code shall be determined through the use of computer software, worksheets, compliance manuals and other similar materials which meet the intent of this code. Such approved compliance methodologies and materials shall include, but not be limited to, the COMcheck Compliance Materials developed by US-DOE or other software approved by the Vermont Department of Public Service. Refer to section 104 for construction document requirements.

Revise Section 101.4: Scope

101.4 Scope. This code establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof that provide facilities or shelter for

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public assembly, educational, business, mercantile, institutional, storage and multi-family residential occupancies greater than 3 stories, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. This code thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in these buildings and structures.

Revise Section 101.4.1: Exempt Buildings

101.4.1 Exempt buildings. Buildings and structures indicated in Sections 101.4.1.1, ~~and~~ 101.4.1.2, 101.4.1.3 and 101.4.1.4 shall be exempt from the provisions of this code. Commercial buildings provided with service water heating and/or electric lighting shall meet the applicable provisions of Chapter 7 or 8 regardless of this exempt status.

101.4.1.1 Separated buildings. Buildings and structures, or portions thereof separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for all purposes.

101.4.1.2 Unconditioned buildings. Buildings and structures or portions thereof which are neither heated nor cooled.

101.4.1.3 Greenhouses. Structures used exclusively for non-retail horticulture purposes and applications that do not use mechanical ventilation or artificial illumination.

101.4.1.4 Barns. Structures for the purpose of housing, maintaining, controlling, and processing (such as milking and shearing) animals and storage of hay and other field products. Barns in this definition are not intended for occupancy by humans or for day long occupancy of humans to perform their applicable duties.

101.4.1.5 Buildings with conditioned floor area not exceeding 5,000 sf may be designed and constructed using the envelope requirement of the RBES

Revise Section 101.4.2: Applicability

101.4.2 Applicability. The provisions of this code shall apply to all matters affecting or relating to structures and premises, as set forth in Section 101. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. All commercial building construction shall comply with either Chapter 7 or Chapter 8.

101.4.2.1 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of an existing building envelope, mechanical, service water-heating, electrical distribution or illumination system lawfully in existence at the time of the adoption of this code.

101.4.2.2 Additions, alterations, or repairs. Additions, alterations, ~~renovations~~ or repairs to a building envelope, mechanical, service water-heating, electrical distribution or illumination system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing system(s) to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded.

101.4.2.2.1 Additions, alterations, or repairs: Additions, alterations and repairs involve modifications to an existing building envelope and energy using systems or equipment. Alterations and additions to include:

101.4.2.2.1.1 All new HVAC and water heating equipment that is covered by the minimum efficiency requirements within the code. Any new equipment or system installed must comply with requirements applicable to those systems or equipment. Any motors replaced in the HVAC or plumbing systems shall meet minimum motor efficiencies per the code.

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**Exceptions to 101.4.2.2.1.1:**

- (a) for equipment that is being modified or repaired but not replaced provided that such modifications will not result in an increase in energy usage, or
- (b) where a replacement or alteration of equipment requires extensive revisions to other systems, equipment, or elements of a building and such replaced or altered equipment is a like-for-like replacement, or
- (c) for a refrigerant change of existing equipment, or
- (d) for the relocation of existing equipment.

101.4.2.2.1.2 The replacement of lighting systems in any building space shall comply with the lighting power density requirements of Chapters 7 or 8 applicable to that space. New lighting systems shall comply with the applicable lighting power density requirements of Chapters 7 or 8. Any new control devices as a direct replacement of existing control devices shall comply with the specific requirements of Chapters 7 or 8

Exception to 101.4.2.2.1.2: Alterations that replace less than 50% of the luminaires in a space need not comply with these requirements provided that such alterations do not increase the installed interior lighting power.

101.4.2.2.1.3 Alterations and additions to a building's exterior and exterior window system (fenestration) when more than 25% of a building's window area (sq. ft.) is upgraded.

Exceptions to 101.4.2.2.1.3: The following alterations need not comply with these requirements provided such alterations will not increase the energy usage of the building:

- (a) Installation of storm windows over existing glazing,
- (b) replacement of glazing in existing sash and frame provided the U-factor and solar heat gain coefficient (SHGC) will be equal to or lower than before the glass replacement,
- (c) alterations to roof/ceiling, wall, or floor cavities, which are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.,
- (d) alterations to walls and floors without framing cavities,
- (e) replacement of a roof membrane where either the roof sheathing or roof insulation is not exposed or, if there is existing roof insulation, below the roof deck,
- (f) replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a conditioned space from the exterior shall not be removed, and
- (g) replacement of existing fenestration, provided, however, that the area of the replacement fenestration does not exceed 25% of the total fenestration area of an existing building and that the U-factor and solar heat gain coefficient (SHGC) will be equal to or lower than before the fenestration replacement.

101.4.2.2.1.4 Additions to existing buildings. An extension or increase in floor area or height of a building outside of the existing building envelope shall comply with the provisions of Chapters 7 or 8 applicable to building envelope, heating, ventilating, air-conditioning, service water heating, lighting, and other systems and equipment.. Compliance shall be demonstrated in one of two ways:

- (a) the addition alone shall comply with the applicable requirements, or
- (b) the addition shall not increase the energy consumption of the existing building plus the addition beyond the energy that would be consumed by the existing building plus the addition if the addition alone did comply.

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Exception to 101.4.2.2.1.4: When HVAC or *service water heating* to an *addition* is provided by existing HVAC or *service water heating systems* and equipment, such existing *systems* and *equipment* shall not be required to comply with this code. However, any new *systems* or *equipment* installed must comply with specific requirements applicable to those *systems* and *equipment*.

101.4.2.3 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or moving of buildings or structures shall not be mandatory for existing buildings or structures specifically identified and classified as historically significant by the state or local jurisdiction or listed in *The National Register of Historic Places* or which have been determined to be eligible for such listing or included in the Vermont State Register of Historic Places.

101.4.2.4 Change in occupancy. It shall be unlawful to make a change in the occupancy of any building or structure which would result in an increase in demand for either fossil fuel or electrical energy supply unless such building or structure is made to comply with the requirements of this code or otherwise approved by the authority having jurisdiction. The code official shall certify that such building or structure meets the intent of the provisions of the law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any increase in demand for either fossil fuel or electrical energy supply or any hazard to the public health, safety or welfare.

101.4.3 Mixed Occupancy. When a building houses more than one occupancy, each portion shall conform to the requirements for the occupancy housed therein. Where minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, the major use shall be considered the building occupancy. Buildings other than Type A-1 Residential Buildings, with a height of four or more stories above grade shall be considered commercial buildings for the purpose of this code, regardless of the number of floors that are classified as residential occupancy.

101.4.4 Industrial Processes. This code shall not apply to equipment or portions of building energy systems that use energy primarily to provide for industrial, manufacturing or commercial processes.

104 – CONSTRUCTION DOCUMENTS

Delete entire section 104 and replace with new as follows:

104 – CONSTRUCTION COMPLIANCE DOCUMENTS

104.1 Plans and Specifications: A set of construction documents including plans and specifications shall be submitted to the code official. All building envelope, mechanical, lighting, and electric power distribution system plans and specifications shall contain sufficient information to identify and verify all of the building envelope assembly with thermal and solar ratings; all mechanical system components and arrangements; all mechanical equipment capacities with efficiency ratings, including all motors; all lighting systems arrangements; all lighting ratings; all lighting and mechanical systems sequence(s) of operation.

Exception: The code official is authorized to waive the submission of specific compliance documents for energy efficiency compliance purposes if it is found that the nature of the work applied for is such that reviewing of documents is not necessary to obtain compliance with this code. This exception typically applies to simple commercial construction projects involving system alterations, replacements or repairs that are not associated with new building construction or substantial renovation projects.

104.1.1 Design: All building envelope, mechanical, lighting, and electric power distribution systems including controls, sequence(s) of operation and supporting documentation shall be designed and specified by a qualified professional as consistent with the professional licensing and registration laws of Vermont and the Vermont Labor & Industry Building & Fire Prevention Code.

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104.1.2 Administration: The qualified design professional or other legally recognized professional appointed by the design professional or owner shall be responsible for the review and certification that all submittals and shop drawings conform to the building envelope, mechanical, lighting, and electric power distribution construction documents.

104.1.3 System Operation & Maintenance: Operation and maintenance manuals (O&M's) shall be provided to the building owner by the contractor for all systems impacting energy use.

- 1 O&M submission as a condition of final acceptance shall be part of the construction documents and construction documents shall include a description of their format and content.
- 2 The operation manuals shall provide all relevant information needed for day-to-day operation and management of each system so as not to degrade the energy efficiency levels and operation as installed.
- 3 The maintenance manuals shall describe equipment inventory and support the intended building maintenance program so as not to degrade the equipment performance energy efficiency levels as installed.

104.2 Documentation for Verification and Operations: A summary of the design, construction features and systems shall be provided to the code official and building owner. This summary shall contain sufficient information to completely describe the building systems (building envelope, mechanical systems; service water heating; lighting systems; and electric power distribution systems), including operational features and controls. The information required for each building system shall include:

1. A basic description of the building systems design intent including a listing of the ideas, concepts, limitations and criteria that have been defined by the owner and design team to be important to achieve energy efficiency guidelines (Descriptive Narrative).
2. A listing of the building systems component performance ratings including U-value and R-value ratings and lighting, transformer, motor equipment efficiency ratings and capacities. This may be provided using prepared forms from the Vermont COMcheck Compliance Guideline Manual.
3. A summary of building lighting, heating and cooling (if applied) loads. A summary shall be provided on a system or zone basis indicating relationship of HVAC calculated load to equipment capacity.
4. A description of the sequence of operation of the mechanical and lighting systems and their interaction with other systems, including fire prevention and fire protection systems. A reference to specific sections in the project specifications or drawings containing this description is an acceptable form of compliance.
5. A description of the mechanical and lighting systems testing requirements and the criteria for passing to be used for final systems acceptance. A reference to specific sections in the project specifications or drawings containing this description is an acceptable form of compliance.

Approval by the code official of the design concepts, testing procedures, and acceptance criteria of 104.2, 1 through 5, is not required, but the code official may reject the compliance documents if these sections are incomplete, or if they specify any design elements that violate other requirements of the code.

Exception:

The code official is authorized to waive the submission of specific compliance documents for energy efficiency compliance purposes if it is found that the nature of the work applied for is such that reviewing of documents is not necessary to obtain compliance with this code. This exception typically applies to simple commercial construction projects involving system alterations, replacements or repairs that are not associated with new building construction or substantial renovation projects.

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104.3 Acceptance: All building systems, including envelope mechanical, lighting control, and electric power distribution systems shall be installed in accordance with the construction documents and installation shall be verified and tested in accordance with the applicable standards of the code and construction documents. In addition, the following documents shall be submitted to the code official and owner prior to permanent occupancy.

Exception:

The code official is authorized to waive the submission of specific compliance documents for energy efficiency compliance purposes if it is found that the nature of the work applied for is such that reviewing of documents is not necessary to obtain compliance with this code. This exception typically applies to simple commercial construction projects involving system alterations, replacements or repairs that are not associated with new building construction or substantial renovation projects.

1. Certification from the qualified design professional (s), building owner/developer or authorized representative stating that the building envelope, mechanical, lighting, and electric power distribution systems have been installed in substantial accord with the approved construction documents.
2. Confirmation by the building owner/developer or authorized representative that they have received all building envelope, mechanical, lighting, and electric power distribution system record drawings from the installing contractors and that the qualified design professional or other appointed or legally recognized professional has reviewed their reasonable accuracy.
3. Confirmation by the building owner/developer or authorized representative that they have received all construction documents required in 104.1 & 104.2 including reports, controls documentation, operation manual(s) and maintenance manual(s).
4. Documentation from the design professional or other qualified appointed professional that the mechanical and lighting systems are performing to their sequence of operation as designed. For DDC HVAC controls system, a trend report of the accepted systems shall document compliance to design requirements.

Chapter 2: Definitions

Revise “COMMERCIAL BUILDING”:

COMMERCIAL BUILDING. ~~All buildings over three stories in height above grade or buildings other than residential buildings, that are three stories or less in height above grade. Any building as defined in 21 VSA §251a, that is a commercial or industrial building, or that is a multi-family residential building of four or more stories.~~

Add “COMMERCIAL CONSTRUCTION”

COMMERCIAL CONSTRUCTION. Construction of a commercial building, including the building envelope and energy systems and equipment used in conjunction with the commercial building. Commercial construction includes new commercial buildings, new portions of commercial buildings and new energy systems and equipment in existing commercial buildings.

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Add “EQUIPMENT”

EQUIPMENT. Devices for comfort conditioning, electric power, lighting, distribution or service water heating, including, but not limited to: furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators, pumps, fans or other devices or installations.

Add “GREENHOUSE”

GREENHOUSE. An enclosed detached or attached accessory structure consisting primarily of light transmitting materials and used exclusively for growing plants.

Chapter 3: Design Conditions

Revise Table 302.1 as follows:

Winter Design Dry-bulb: -11⁰F (ASHRAE 1997 Fundamentals HB, 99.6%)

Summer Design Dry-bulb: 84⁰F (ASHRAE 1997 Fundamentals HB, 1%)

Summer Design Wet-bulb: 69⁰F (ASHRAE 1997 Fundamentals HB, 1%)

Heating Degree Days: 7771 (ASHRAE 90.1-1999 table D-1) 65 base

Cooling Degree Days: 2228 (ASHRAE 90.1-1999 table D-1) 50 base

*Climate Zone: **MODIFIED ZONE 16 TABLE USED FOR ENVELOPE CRITERIA PER APPENDIX “A”***

Delete Figures 302.1(1) through 302.1(45) and Figures 302.1(47) through 302.1(51).

Chapter 4: Residential Building Design by Systems Analysis and Design of Buildings Utilizing Renewable Energy Sources

Delete entire Chapter and refer to Sec 21 V.S.A. § 266 (RBES).

All residential buildings of Type A-1 and/or Type A-2 (detached one and two family dwellings and mutlti-family dwellings of 3 stories or less in height) shall comply with Sec. 21 V.S.A. § 266, the Residential Building Energy Standards (RBES).

Chapter 5: Residential Building Design by Component Performance Approach

Delete entire Chapter and refer to Sec 21 V.S.A. § 266 (RBES), with the following exception:

Table 504.2, MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT.

All residential buildings of Type A-1 and/or Type A-2 (detached one and two family dwellings and mutlti-family dwellings of 3 stories or less in height) shall comply with Sec. 21 V.S.A. § 266, the Residential Building Energy Standards (RBES).

Chapter 6: Design by Acceptable Practice for Low-Rise Residential Buildings

Delete entire Chapter and refer to Sec 21 V.S.A. § 266 (RBES)

All residential buildings of Type A-1 and/or Type A-2 (detached one and two family dwellings and mutlti-family dwellings of 3 stories or less in height) shall comply with Sec. 21 V.S.A. § 266, the Residential Building Energy Standards (RBES).

Chapter 7: Building Design for All Commercial Buildings

Revise Section 701.1 as follows:

701.1 General. Commercial buildings shall meet the requirements of ~~ASHRAE/IES Energy Code for Commercial and High-Rise Residential Buildings.~~ ASHRAE/IESNA Standard 90.1-1999 Energy Standard for Buildings Except Low-Rise Residential Buildings. This approach may only be used when the applicant is applying for a permit for, and submits plans and specifications for, the entire project.

Revise ASHRAE 90.1 Envelope Requirement:

Replace reference to Table B-19 with Table B-21 in Table D-1, U.S. Climatic Data, listing for Vermont, Burlington WSO AP. All envelope requirements under ASHRAE 90.1-99 will comply with Table B-21.

Table B-21 Errata:

In non-residential column:

Walls, above grade; metal buildings: U-factor is incorrect. "0.1057" should be "0.057".

Fenestration; vertical glazing; 10.1-20.0% of wall; $SHGC_{all}$ & $SHGC_{north}$ are reversed. $SHGC_{all}$ should = "0.36" and $SHGC_{north}$ should = "0.46."

Revise ASHRAE 90.1-1999 section 11.1.5, Paragraph (a) as follows:

The annual energy use (btuh/sf-yr) and associated energy cost budget for the budget building design and the annual energy use (btuh/sf-yr) and associated design energy cost for the proposed building.

Add ASHRAE 90.1-1999, Section 10.3, Transformer Requirements as follows:

All dry-type transformers shall comply with this code's Amendment, Section 806.3 Transformers contained in this document.

Remaining text unchanged.

Chapter 8: Design by Acceptable Practice for Commercial Buildings

801 – SCOPE

Revise Section 801.2 as follows:

801.2 Application. The requirements in Section 802, 803, 804, ~~and 805 and 806~~ shall each be satisfied on an individual basis. ~~Where one or more of these sections is not satisfied, compliance for that section(s) shall be demonstrated in accordance with the applicable provisions of ASHRAE/IES Energy Code for Commercial and High-Rise Residential Buildings.~~

Exception: ~~Buildings meeting Section 806 provided Sections 802.1.2, 802.3, 803.2.1 or 803.3.1 as applicable, 803.2.2 or 803.3.2 as applicable, 803.2.3 or 803.3.3 as applicable, 803.2.8 or 803.3.6 as applicable, 803.2.9 or 803.3.7 as applicable, 804, 805.2, 805.3, and 805.5 are each satisfied.~~

802 – BUILDING ENVELOPE REQUIREMENTS

Revise Section 802.1 as follows:

802.1 General. Walls, roof assemblies, floors, glazing, and slabs on grade which are part of the building envelope for buildings where window and glazed door area is not greater than 50 percent of the gross area of above-grade walls shall meet the requirements of Sections 802.2.1 through 802.2.8, as applicable. Buildings with more glazing or more skylight area than allowed for in envelope tables shall demonstrate compliance using COMcheck-EZ v.2.X or other ComCheck software approved by the Vermont Department of Public Service or ASHRAE/IESNA Standard 90.1-1999, Chapter 11, Cost Budget Method. ~~meet the applicable provisions of ASHRAE/IES Energy Code for Commercial and High-Rise Residential Buildings.~~

Remaining text unchanged.

Revise Section 802.2 as follows:

802.2 Criteria. The building envelope components shall meet each of the applicable requirements in Tables 802.2(1), 802.2(2), 802.2(3) and 802.2(4), based on the percentage of wall that is glazed. The percentage of wall that is glazed shall be determined by dividing the aggregate area of rough openings for glazing (windows and glazed doors) in all the above grade walls associated with the building envelope by the total gross area of all above grade exterior walls that are a part for the building envelope. In buildings with multiple types of building envelope construction, each building envelope construction type shall be evaluated separately. Where Table 802.2(1), 802.2(2), 802.2(3) and 802.2(4) does not list a particular construction type, the applicable provisions of ~~ASHRAE/IES Energy Code for Commercial and High-Rise Residential Buildings~~ ASHRAE/IESNA Standard 90.1-1999 Energy Standard for Buildings Except Low-Rise Residential Buildings shall be used in lieu of Section 802.

Remaining text unchanged.

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Delete Table 802.2(34):

Delete Table 802.2(34) and replace with attached table, Appendix A titled "Table 802.2(34) Amended, 2001 Vermont Guidelines for Energy Efficient Commercial Construction. – Building Envelope Requirements"

Add Section 802.2.7.1 as follows:

802.2.7.1 Heated slabs on grade. Slabs on grade that contain radiant heating systems shall include the installation of insulating material with a minimum thermal resistance of R-10 under the entire area of the slab. Perimeter insulation shall be as indicated in 802.2.7.

Add Section 802.3.3 as follows:

802.3.3 Dampers integral to the building envelope. Stair, elevator shaft vents, and other dampers integral to the building envelope shall be equipped with motorized dampers with a maximum leakage rate of 3 cfm/ft² at 1.0 in w.g. when tested in accordance with AMCA Standard 500. Such dampers shall be closed during normal building operation and shall open as required by fire and smoke detection systems.

Exception: Gravity (non-motorized) dampers may be used in buildings less than three stories in height above grade.

Add Section 802.3.4 as follows:

802.3.4 Loading dock weatherseals. Cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

Add Section 802.3.5 as follows:

802.3.5 Vestibules. A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 7ft (2.1m) when in the closed position.

Exceptions:

- 1) Doors not intended to be used as a building entrance door, such as mechanical or electrical equipment rooms,
- 2) Doors opening directly from a dwelling unit,
- 3) Doors that open directly from a space less than 2000 ft² (200 m²) in area,
- 4) Revolving doors,
- 5) Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Add Section 802.3.6 as follows:

802.3.6 Recessed Lighting Fixtures. When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and

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- ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC or non-IC rated, installed inside a sealed box constructed from a minimum 1/2-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor barrier, or other air-tight assembly manufactured for this purpose, while maintaining required clearances of not less than 1/2 inch (12.7 mm) from combustible material and not less than 3 inches (76mm) from insulation material.
 3. Type IC rated, in accordance with ASTM E 283 no more than 2.0 cfm (0.944 L/s) air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pa or 1.57 lbs./ft.² pressure difference and shall be labeled.

803 – BUILDING MECHANICAL SYSTEMS:**Add Section 803.1.2 as follows:**

803.1.2 Electric Resistance Space Heating. Building heating with electrical resistance units, including baseboard radiation, heat pump reheat coils, duct coils, boilers, domestic hot water heaters and coils in terminal units and air systems is prohibited.

Exceptions to 803.1.2:

- (a) Areas, such as stairways, that can not be penetrated with piping or duct and no other method of heating is possible,
- (b) Where authority having jurisdiction expressly allows,
- (c) Replacement of existing electrical resistance unit,
- (d) Special conditions of occupancy or use that require electrical resistance heat to maintain health, safety or environmental conditions,
- (e) Limited areas where demonstrated to be a practical application of resistance electrical heat (e.g. small interior space such as a rest room which is distant from the heat distribution system, hazardous material storerooms, stairwell or other means of emergency egress),
- (f) Domestic hot water heaters less than 5 KW in total unit input capacity.

Delete Section 803.2.1.1 Equipment and System Sizing**Revise Section 803.2.3.1, Temperature Controls:**

Delete the words “electrical resistance” from last sentence.

Revise Section 803.2.4 as follows:

803.2.4 Hydronic system controls. Hydronic systems of at least 600,000 Btu/h (175,860 w) design output capacity supplying heated water to comfort conditioning systems shall include controls that meet the requirements of Section 803.3.3.7. Revise Section 803.2.6 as follows:

803.2.6 Cooling with outdoor air. Each system over 9065,000 Btu/h (19 kW) cooling capacity ~~or 3,000 cfm (1,416 L/s) located in other than Climate Zones 1, 2, or 3b, 5a or 6b as shown in Table 302.1~~ shall have an economizer that will automatically shut off the cooling system and allow all of the supply air to be provided directly from outdoors. Economizers shall be capable of operating at 100% outside air, even if additional mechanical cooling is required to meet the cooling load of the building. Where a single room

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or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions:

- ~~1) Where the cooling equipment is covered by the minimum efficiency requirements of Table 803.2.2(1) or 803.2.2(2) and meets the efficiency requirements of Table 803.2.6.~~
- 12) Systems with air or evaporatively cooled condensers and which serve spaces with open case refrigeration or that require filtration equipment in order to meet Section 403.3 of the International Mechanical Code.

Revise Section 803.3.2 as follows:

803.3.2 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 803.3.2(1) through 803.3.2(~~3~~7) and Table 803.2.2(5), when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through data furnished by the manufacturer or through certification under an approved certification program. If no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions and/or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrate the combined efficiency of the specified components meets the requirements herein.

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803.3.3 Delete Table 803.2.2(1) through Table 803.2.2(5) and Table 803.3.2(1) through Table 803.3.2(3) and substitute as follows:

TABLE 803.2.2 (1)

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED,
MINIMUM EFFICIENCY REQUIREMENTS

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Minimum Efficiency^c</u>	<u>Efficiency as of 10/29/2001^b</u>	<u>Test Procedure^a</u>
<u>Air Conditioners, Air Cooled</u>	< 65,000 Btu/h ^d	<u>Split System</u>	<u>10.0 SEER</u>	<u>10.0 SEER</u>	<u>ARI 210/240</u>
		<u>Single Package</u>	<u>9.7 SEER</u>	<u>9.7 SEER</u>	
	<u>≥65,000 Btu/h and < 135,000 Btu/h</u>	<u>Split System and Single Package</u>	<u>8.9 EER^c</u>	<u>10.3 EER^c</u>	<u>ARI 340/360</u>
		<u>Split System and Single Package</u>	<u>8.5 EER^c</u>	<u>9.7 EER^c</u>	
	<u>≥ 240,000 Btu/h and < 760,000 Btu/h</u>	<u>Split System and Single Package</u>	<u>8.5 EER^c</u>	<u>9.5 EER^c</u>	
		<u>Single Package</u>	<u>7.5 IPLV^c</u>	<u>9.7 IPLV^c</u>	
<u>Air Conditioners, Water and Evaporatively Cooled</u>	< 65,000 Btu/h	<u>Split System and Single Package</u>	<u>9.3 EER</u>	<u>12.1 EER</u>	<u>ARI 210/240</u>
		<u>Split System and Single Package</u>	<u>10.5 EER^c</u>	<u>11.5 EER^c</u>	
	<u>≥135,000 Btu/h and ≤240,000 Btu/h</u>	<u>Split System and Single Package</u>	<u>9.6 EER^c</u>	<u>11.0 EER^c</u>	<u>ARI 340/360</u>
		<u>Split System and Single Package</u>	<u>9.6 EER^c</u>	<u>11.0 EER^c</u>	
	<u>> 240,000 Btu/h</u>	<u>Split System and Single Package</u>	<u>9.0 IPLV^c</u>	<u>10.3 IPLV^c</u>	

^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

^b IPLVs are only applicable to equipment with capacity modulation.

^c Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

^d Single-phase air-cooled air-conditioners < 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**TABLE 803.2.2 (2)****UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS**

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Efficiency as of 10/29/2001 ^b	Test Procedure ^a
Air Cooled, (Cooling Mode)	< 65,000 Btu/h ^d	Split System	10.0 SEER	10.0 SEER	ARI 210/240
		Single Package	9.7 SEER	9.7 SEER	
	≥65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	8.9 EER ^c	10.1 EER ^c	ARI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	8.5 EER ^c	9.3 EER ^c	
	≥240,000 Btu/h	Split System and Single Package	8.5 EER ^c 7.5 IPLV ^c	9.0 EER ^c 9.2 IPLV ^c	
Water-Source (Cooling Mode)	< 17,000 Btu/h	85°F Entering Water	9.3 EER		ARI 320
		86°F Entering Water		11.2 EER	ISO-13256-1
	≥ 17,000 Btu/h and <65,000 Btu/h	85°F Entering Water	9.3 EER		ARI 320
		86°F Entering Water		12.0 EER	ISO-13256-1
	≥65,000 Btu/h and < 135,000 Btu/h	85°F Entering Water	10.5 EER		ARI 320
		86°F Entering Water		12.0 EER	ISO-13256-1
Groundwater-Source (Cooling Mode)	< 135,000 Btu/h	70°F Entering Water	11.0 EER		ARI 325
		59°F Entering Water		16.2 EER	ISO-13256-1
Ground Source (Cooling Mode)	< 135,000 Btu/h	77°F Entering Brine	10.0 EER		ARI 330
		77°F Entering Water		13.4 EER	ISO-13256-1
Air Cooled (Heating Mode)	< 65,000 Btu/h ^d (Cooling Capacity)	Split System	6.8 HSPF	6.8 HSPF	ARI 210/240
		Single Package	6.6 HSPF	6.6 HSPF	
	≥65,000 Btu/h and < 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.0 COP	3.2 COP	ARI 340/360
	≥135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	2.9 COP	3.1 COP	
Water-Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	70°F Entering Water	3.8 COP		ARI 320
		68°F Entering Water		4.2 COP	ISO-13256-1
Groundwater-Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	70°F Entering Water	3.4 COP		ARI 325
		50°F Entering Water		3.6 COP	ISO-13256-1
Ground Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	32°F Entering Brine	2.5 COP		ARI 330
		32°F Entering Water		3.1 COP	ISO-13256-1

^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

^b IPLVs and Part load rating conditions are only applicable to equipment with capacity modulation.

^c Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

^d Single-phase air-cooled heat pumps < 65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.

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TABLE 803.2.2.(3)

**PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS,
ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONER HEAT PUMPS,
ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS**

<u>Equipment Type</u>	<u>Size Category (Input)</u>	<u>Sub-Category or Rating Condition</u>	<u>Minimum Efficiency</u>	<u>Efficiency as of 10/29/2001</u>	<u>Test Procedure^a</u>
<u>PTAC (Cooling Mode) New Construction</u>	<u>All Capacities</u>	<u>95°F db Outdoor Air</u>	<u>10.0 - (0.16 x Cap/1000)^b EER</u>	<u>12.5 - (0.213 x Cap/1000)^b EER</u>	ARI 310/380
<u>PTAC (Cooling Mode) Replacements^c</u>	<u>All Capacities</u>	<u>95°F db Outdoor Air</u>	<u>10.0 - (0.16 x Cap/1000)^b EER</u>	<u>10.9 - (0.213 x Cap/1000)^b EER</u>	
<u>PTHP (Cooling Mode) New Construction</u>	<u>All Capacities</u>	<u>95°F db Outdoor Air</u>	<u>10.0 - (0.16 x Cap/1000)^b EER</u>	<u>12.3 - (0.213 x Cap/1000)^b EER</u>	
<u>PTHP (Cooling Mode) Replacements^c</u>	<u>All Capacities</u>	<u>95°F db Outdoor Air</u>	<u>10.0 - (0.16 x Cap/1000)^b EER</u>	<u>10.8 - (0.213 x Cap/1000)^b EER</u>	
<u>PTHP (Heating Mode) New Construction</u>	<u>All Capacities</u>		<u>2.9 - (0.026 x Cap/1000)^b COP</u>	<u>3.2 - (0.026 x Cap/1000)^b COP</u>	
<u>PTHP (Heating Mode) Replacements^c</u>	<u>All Capacities</u>		<u>2.9 - (0.026 x Cap/1000)^b COP</u>	<u>2.9 - (0.026 x Cap/1000)^b COP</u>	
^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.					
^b Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.					
^c Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16-in. high and less than 42-in. wide.					

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TABLE 803.2.2 (4)

WARM AIR FURNACES, WARM AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency ^d	Efficiency as of 10/29/2001 ^d	Test Procedure ^a
Warm Air Furnace, Gas-Fired	< 225,000 Btu/h (66 kW)		78% AFUE or 80% E _c ^e	78% AFUE or 80% E _c ^e	DOE 10 CFR Part 430 or ANSI Z21.47
	≥225,000 Btu/h (66 kW)	Maximum Capacity ^c	80% E _t	80% E _c ^f	ANSI Z21.47
Warm Air Furnace, Oil-Fired	< 225,000 Btu/h (66 kW)		78% AFUE or 80% E _c ^e	78% AFUE or 80% E _c ^e	DOE 10 CFR Part 430 or UL 727
	≥225,000 Btu/h (66 kW)	Maximum Capacity ^b	81% E _t	81% E _c ^g	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity ^b	78% E _t	80% E _c ^g	ANSI Z83.9
		Minimum Capacity ^b	75% E _t	—	
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity ^b	78% E _t	80% E _c ^g	ANSI Z83.8
		Minimum Capacity ^b	74% E _t	—	
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity ^b	81% E _t	80% E _c ^g	UL 731
		Minimum Capacity ^b	81% E _t	—	

^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

^b Minimum and maximum ratings as provided for and allowed by the unit's controls.

^c Combination units not covered by NAECA (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) may comply with either rating.

^d E_t = Thermal efficiency. See test procedure for detailed discussion.

^e E_c = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

^f E_c = Combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

^g E_t = Thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**TABLE 803.2.2.(5)****BOILERS, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS**

<u>Equipment Type^f</u>	<u>Size Category (Input)</u>	<u>Sub-Category or Rating Condition</u>	<u>Minimum Efficiency^{c,e}</u>	<u>Efficiency as of 10/29/2001^d</u>	<u>Test Procedure</u>
<u>Boilers, Gas-Fired</u>	<u>< 300,000 Btu/h</u>	<u>Hot Water</u>	<u>80% AFUE</u>	<u>80% AFUE</u>	<u>DOE 10 CFR Part 430</u>
		<u>Steam</u>	<u>75% AFUE</u>	<u>75% AFUE</u>	
	<u>≥300,000 Btu/h and ≤ 2,500,000 Btu/h</u>	<u>Maximum Capacity^b</u>	<u>80% E_c</u>	<u>75% E_t</u>	<u>H.I. Htg Boiler Std</u>
	<u>> 2,500,000 Btu/h^f</u>	<u>Hot Water</u>	<u>80% E_c</u>	<u>80% E_c</u>	
	<u>> 2,500,000 Btu/h^f</u>	<u>Steam</u>	<u>80% E_c</u>	<u>80% E_c</u>	
<u>Boilers, Oil-Fired</u>	<u>< 300,000 Btu/h</u>		<u>80% AFUE</u>	<u>80% AFUE</u>	<u>DOE 10 CFR Part 430</u>
	<u>≥300,000 Btu/h and ≤ 2,500,000 Btu/h</u>	<u>Maximum Capacity^b</u>	<u>83% E_c</u>	<u>78% E_t</u>	<u>H.I. Htg Boiler Std</u>
	<u>> 2,500,000 Btu/h^f</u>	<u>Hot Water</u>	<u>83% E_c</u>	<u>83% E_c</u>	
	<u>> 2,500,000 Btu/h^f</u>	<u>Steam</u>	<u>83% E_c</u>	<u>83% E_c</u>	
<u>Oil-Fired (Residual)</u>	<u>≥300,000 Btu/h and ≤2,500,000 Btu/h</u>	<u>Maximum Capacity^b</u>	<u>83% E_c</u>	<u>78% E_t</u>	<u>H.I. Htg Boiler Std</u>
	<u>> 2,500,000 Btu/h^f</u>	<u>Hot Water</u>	<u>83% E_c</u>	<u>83% E_c</u>	
	<u>> 2,500,000 Btu/h^f</u>	<u>Steam</u>	<u>83% E_c</u>	<u>83% E_c</u>	
^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. ^b Minimum and maximum ratings as provided for and allowed by the unit's controls. ^c E _c = Combustion efficiency (100% less flue losses). See reference document for detailed information. ^d E _t = Thermal efficiency. See reference document for detailed information. ^e Alternate test procedures used at the manufacturer's option are ASME PTC-4.1 for units over 5,000,000 Btu/h input, or ANSI Z21.13 for units greater than or equal to 300,000 Btu/h and less than or equal to 2,500,000 Btu/h input. ^f These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.					

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TABLE 803.3.2 (1)
CONDENSING UNITS, ELECTRICALLY OPERATED,
MINIMUM EFFICIENCY REQUIREMENTS

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Minimum Efficiency^b</u>	<u>Efficiency as of 10/29/2001^b</u>	<u>Test Procedure^a</u>
<u>Condensing Units, Air Cooled</u>	<u>≥135,000 Btu/h</u>		<u>9.9 EER</u> <u>11.0 IPLV</u>	<u>10.1 EER</u> <u>11.2 IPLV</u>	<u>ARI 365</u>
<u>Condensing Units, Water or Evaporatively Cooled</u>	<u>≥135,000 Btu/h</u>		<u>12.9 EER</u> <u>12.9 IPLV</u>	<u>13.1 EER</u> <u>13.1 IPLV</u>	
^a <u>Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.</u>					
^b <u>IPLVs are only applicable to equipment with capacity modulation.</u>					

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**TABLE 803.3.2.(2)****WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS**

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Efficiency as of 10/29/2001 ^b	Test Procedure ^a
<u>Air Cooled, With Condenser, Electrically Operated</u>	<u>< 150 Tons</u>		<u>2.70 COP</u> <u>2.80 IPLV</u>	<u>2.80 COP</u> <u>2.80 IPLV</u>	<u>ARI 550</u> or <u>ARI 590</u> as appropriate
	<u>≥150 Tons</u>		<u>2.50 COP</u> <u>2.50 IPLV</u>		
<u>Air Cooled, Without Condenser, Electrically Operated</u>	<u>All Capacities</u>		<u>3.10 COP</u> <u>3.20 IPLV</u>	<u>3.10 COP</u> <u>3.10 IPLV</u>	
<u>Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)</u>	<u>All Capacities</u>		<u>3.80 COP</u> <u>3.90 IPLV</u>	<u>4.20 COP</u> <u>4.65 IPLV</u>	<u>ARI 590</u>
<u>Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)</u>	<u>< 150 Tons</u>		<u>3.80 COP</u> <u>3.90 IPLV</u>	<u>4.45 COP</u> <u>4.50 IPLV</u>	<u>ARI 550</u> or <u>ARI 590</u> as appropriate
	<u>≥150 Tons and < 300 Tons</u>		<u>4.20 COP</u> <u>4.50 IPLV</u>	<u>4.90 COP</u> <u>4.95 IPLV</u>	
	<u>≥300 Tons</u>		<u>5.20 COP</u> <u>5.30 IPLV</u>	<u>5.50 COP</u> <u>5.60 IPLV</u>	
<u>Water Cooled, Electrically Operated, Centrifugal^c</u>	<u>< 150 Tons</u>		<u>3.80 COP</u> <u>3.90 IPLV</u>	<u>5.00 COP</u> <u>5.00 IPLV</u>	<u>ARI 550</u>
	<u>≥150 Tons and < 300 Tons</u>		<u>4.20 COP</u> <u>4.50 IPLV</u>	<u>5.55 COP</u> <u>5.55 IPLV</u>	
	<u>≥300 Tons</u>		<u>5.20 COP</u> <u>5.30 IPLV</u>	<u>6.10 COP</u> <u>6.10 IPLV</u>	
<u>Air Cooled Absorption Single Effect</u>	<u>All Capacities</u>		<u>0.48 COP</u>	<u>0.60 COP</u>	<u>ARI 560</u>
<u>Water Cooled Absorption Single Effect</u>	<u>All Capacities</u>		<u>0.60 COP</u>	<u>0.70 COP</u>	
<u>Absorption Double Effect, Indirect-Fired</u>	<u>All Capacities</u>		<u>0.95 COP</u> <u>1.00 IPLV</u>	<u>1.00 COP</u> <u>1.05 IPLV</u>	
<u>Absorption Double Effect, Direct-Fired</u>	<u>All Capacities</u>		<u>0.95 COP</u> <u>1.00 IPLV</u>	<u>1.00 COP</u> <u>1.00 IPLV</u>	

^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

^b The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

^c Equipment not designed for operation at ARI Standard test conditions of 44 °F leaving chilled water temperature and 85 °F entering condenser water temperature shall have a minimum full load COP and IPLV rating as shown in Tables 703.3.2(3) through 703.3.2(5). The table values are only applicable over the following full load design ranges:

Leaving Chilled Water Temperature:	40 to 48 °F
Entering Condenser Water Temperature:	75 to 85 °F
Condensing Water Temperature Rise:	5 to 15 °F

Chillers designed to operate outside of these ranges are not covered by this standard.

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TABLE 803.3.2 (3)

COPS AND IPLVS FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Centrifugal Chillers < 150 Tons								
COP _{std} = 5.4								
			Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required COP and IPLV					
46	75	29	6.00	6.27	6.48	6.80	7.03	7.20
45	75	30	5.92	6.17	6.37	6.66	6.87	7.02
44	75	31	5.84	6.08	6.26	6.53	6.71	6.86
43	75	32	5.75	5.99	6.16	6.40	6.58	6.71
42	75	33	5.67	5.90	6.06	6.29	6.45	6.57
41	75	34	5.59	5.82	5.98	6.19	6.34	6.44
46	80	34	5.59	5.82	5.98	6.19	6.34	6.44
40	75	35	5.50	5.74	5.89	6.10	6.23	6.33
45	80	35	5.50	5.74	5.89	6.10	6.23	6.33
44	80	36	5.41	5.66	5.81	6.01	6.13	6.22
43	80	37	5.31	5.57	5.73	5.92	6.04	6.13
42	80	38	5.21	5.48	5.64	5.84	5.95	6.04
41	80	39	5.09	5.39	5.56	5.76	5.87	5.95
46	85	39	5.09	5.39	5.56	5.76	5.87	5.95
40	80	40	4.96	5.29	5.47	5.67	5.79	5.86
45	85	40	4.96	5.29	5.47	5.67	5.79	5.86
44	85	41	4.83	5.18	5.40	5.59	5.71	5.78
43	85	42	4.68	5.07	5.28	5.50	5.62	5.70
42	85	43	4.51	4.94	5.17	5.41	5.54	5.62
41	85	44	4.33	4.80	5.05	5.31	5.45	5.53
40	85	45	4.13	4.65	4.92	5.21	5.35	5.44
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68
^a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature ^b Condenser DT = Leaving Condenser Water Temperature (F) – Entering Condenser Water Temperature (F) $K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$ where X = Condenser DT + LIFT $COP_{adj} = K_{adj} * COP_{std}$								

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TABLE 803.3.2 (4)
COPS AND IPLVS FOR NON-STANDARD CENTRIFUGAL CHILLERS
> 150 TONS, £ 300 TONS

Centrifugal Chillers > 150 Tons, ≤ 300 Tons									
COP _{std} = 5.55									
			Condenser Flow Rate						
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required COP and IPLV						
46	75	29	6.17	6.44	6.66	6.99	7.23	7.40	
45	75	30	6.08	6.34	6.54	6.84	7.06	7.22	
44	75	31	6.00	6.24	6.43	6.71	6.90	7.05	
43	75	32	5.91	6.15	6.33	6.58	6.76	6.89	
42	75	33	5.83	6.07	6.23	6.47	6.63	6.75	
41	75	34	5.74	5.98	6.14	6.36	6.51	6.62	
46	80	34	5.74	5.98	6.14	6.36	6.51	6.62	
40	75	35	5.65	5.90	6.05	6.26	6.40	6.51	
45	80	35	5.65	5.90	6.05	6.26	6.40	6.51	
44	80	36	5.56	5.81	5.97	6.17	6.30	6.40	
43	80	37	5.46	5.73	5.89	6.08	6.21	6.30	
42	80	38	5.35	5.64	5.80	6.00	6.12	6.20	
41	80	39	5.23	5.54	5.71	5.91	6.03	6.11	
46	85	39	5.23	5.54	5.71	5.91	6.03	6.11	
40	80	40	5.10	5.44	5.62	5.83	5.95	6.03	
45	85	40	5.10	5.44	5.62	5.83	5.95	6.03	
44	85	41	4.96	5.33	5.55	5.74	5.86	5.94	
43	85	42	4.81	5.21	5.42	5.66	5.78	5.86	
42	85	43	4.63	5.08	5.31	5.56	5.69	5.77	
41	85	44	4.45	4.93	5.19	5.46	5.60	5.69	
40	85	45	4.24	4.77	5.06	5.35	5.50	5.59	
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68	
^a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature ^b Condenser DT = Leaving Condenser Water Temperature (F) - Entering Condenser Water Temperature (F) $K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$ where X = Condenser DT + LIFT $COP_{adj} = K_{adj} * COP_{std}$									

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TABLE 803.3.2(5)
COPS AND IPLVS FOR NON-STANDARD CENTRIFUGAL CHILLERS > 300 TONS

Centrifugal Chillers > 300 Tons								
COP _{std} = 6.1								
			Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required COP and IPLV					
46	75	29	6.80	7.11	7.35	7.71	7.97	8.16
45	75	30	6.71	6.99	7.21	7.55	7.78	7.96
44	75	31	6.61	6.89	7.09	7.40	7.61	7.77
43	75	32	6.52	6.79	6.98	7.26	7.45	7.60
42	75	33	6.43	6.69	6.87	7.13	7.31	7.44
41	75	34	6.33	6.60	6.77	7.02	7.18	7.30
46	80	34	6.33	6.60	6.77	7.02	7.18	7.30
40	75	35	6.23	6.50	6.68	6.91	7.06	7.17
45	80	35	6.23	6.50	6.68	6.91	7.06	7.17
44	80	36	6.13	6.41	6.58	6.81	6.95	7.05
43	80	37	6.02	6.31	6.49	6.71	6.85	6.94
42	80	38	5.90	6.21	6.40	6.61	6.75	6.84
41	80	39	5.77	6.11	6.30	6.52	6.65	6.74
46	85	39	5.77	6.11	6.30	6.52	6.65	6.74
40	80	40	5.63	6.00	6.20	6.43	6.56	6.65
45	85	40	5.63	6.00	6.20	6.43	6.56	6.65
44	85	41	5.47	5.87	6.10	6.33	6.47	6.55
43	85	42	5.30	5.74	5.98	6.24	6.37	6.46
42	85	43	5.11	5.60	5.86	6.13	6.28	6.37
41	85	44	4.90	5.44	5.72	6.02	6.17	6.27
40	85	45	4.68	5.26	5.58	5.90	6.07	6.17
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68
^a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature ^b Condenser DT = Leaving Condenser Water Temperature (F) - Entering Condenser Water Temperature (F) $K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$ where X = Condenser DT + LIFT $COP_{adj} = K_{adj} * COP_{std}$								

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**TABLE 803.3.2(6)****PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT**

<u>Equipment Type</u>	<u>Total System Heat Rejection Capacity at Rated Conditions</u>	<u>Sub-Category or Rating Condition</u>	<u>Performance Required as of 10/29/2001^{a,b}</u>	<u>Test Procedure^c</u>
<u>Propeller or Axial Fan Cooling Towers</u>	<u>All</u>	<u>95°F (35°C) Entering Water</u> <u>85°F (29°C) Leaving Water</u> <u>75°F (24°C) wb Outdoor Air</u>	<u>≥38.2 gpm/hp</u> <u>(3.23 L/s· kW)</u>	<u>CTI ATC-105</u> <u>and</u> <u>CTI STD-201</u>
<u>Centrifugal Fan Cooling Towers</u>	<u>All</u>	<u>95°F (35°C) Entering Water</u> <u>85°F (29°C) Leaving Water</u> <u>75°F (24°C) wb Outdoor Air</u>	<u>20.0 gpm/hp</u> <u>(1.7 L/s· kW)</u>	<u>CTI ATC-105</u> <u>and</u> <u>CTI STD-201</u>
<u>Air Cooled Condensers</u>	<u>All</u>	<u>125°F (52°C) Condensing Temperature</u> <u>R22 Test Fluid</u> <u>190°F (88°C) Entering Gas Temperature</u> <u>15°F (8°C) Subcooling</u> <u>95°F (35°C) Entering Drybulb</u>	<u>≥176,000 Btu/h· hp</u> <u>(69 COP)</u>	<u>ARI 460</u>
^a For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power. ^b For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power. ^c Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.				

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)**TABLE 803.3.2 (7)****WARM AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS**

<u>Equipment Type</u>	<u>Size Category (Input)</u>	<u>Sub-Category or Rating Condition</u>	<u>Minimum Efficiency^d</u>	<u>Efficiency as of 10/29/2001^d</u>	<u>Test Procedure^a</u>
<u>Warm Air Duct Furnaces, Gas-Fired</u>	<u>All Capacities</u>	<u>Maximum Capacity^b</u>	<u>78% E_t</u>	<u>80% E_c^a</u>	<u>ANSI Z83.9</u>
		<u>Minimum Capacity^b</u>	<u>75% E_t</u>	<u>—</u>	
<u>Warm Air Unit Heaters, Gas-Fired</u>	<u>All Capacities</u>	<u>Maximum Capacity^b</u>	<u>78% E_t</u>	<u>80% E_c^a</u>	<u>ANSI Z83.8</u>
		<u>Minimum Capacity^b</u>	<u>74% E_t</u>	<u>—</u>	
<u>Warm Air Unit Heaters, Oil-Fired</u>	<u>All Capacities</u>	<u>Maximum Capacity^b</u>	<u>81% E_t</u>	<u>80% E_c^a</u>	<u>UL 731</u>
		<u>Minimum Capacity^b</u>	<u>81% E_t</u>	<u>—</u>	

^a Chapter 9 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

^b Minimum and maximum ratings as provided for and allowed by the unit's controls.

^c Combination units not covered by NAECA (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) may comply with either rating.

^d E_t = Thermal efficiency. See test procedure for detailed discussion.

^e E_c = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

^f E_c = Combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

^g E_t = Thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

Revise Section 803.3.3.5 as follows:

803.3.3.5 Economizers. Economizers shall be provided on each system over ~~9065,000~~ 65,000 Btu/h (19 kW) cooling capacity ~~or 3,000 (1,416 L/s) cfm~~ in accordance with Section 803.2.6.

Exception: Water economizers that are capable of cooling supply air by direct and/or indirect evaporation and providing up to 100% of the expected system cooling load at outside air temperatures of 50° F (10° C) dry bulb/45° F (7.2° C) wet bulb and below.

Revise Section 803.3.3.6 as follows:

803.3.3.6 Variable Air Volume (VAV) fan control. Individual VAV fans with motors of at least 25 hp (18.8 Kw) or greater shall be driven by a mechanical or electrical variable speed drive; be a vane-axial fan with variable pitch blades; or the fan motor shall have controls or devices that will result in fan motor demand of no more than ~~50~~30% of design wattage at 50% of design air volume when static pressure set point equals 1/3 of the total design static pressure, based on manufacturer's certified fan data.

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Revise section 803.3.3.7:

803.3.3.7 Hydronic systems controls. Individual hydronic heating and cooling units shall have separate hot water and chilled water supply and return piping. Systems shall not have the capability to supply hot and chilled water concurrently to any terminal unit.

Exceptions:

- (a) Zones where special humidity levels are required to satisfy process needs.
- (b) **Two-Pipe Changeover System** Systems that use a common distribution system to supply both heated and chilled water are acceptable provided all of the following are met:
 - a. The system is designed to allow a deadband between changeover from one mode to the other of at least 15⁰F outside air temperature.
 - b. The system is designed to operate and is provided with controls that will allow operation in one mode for at least four hours before changing over to the other mode.
 - c. Reset controls are provided that allow heating and cooling supply temperatures at the changeover point to be no more than 30⁰F apart.

Add Section 803.3.3.8 as follows:

803.3.3.8 Heat rejection equipment fan speed control. Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exception: Heat rejection devices included as an integral part of the equipment listed in Tables 803.3.2(1) through 803.3.2(4).

Delete Section 803.3.4.1:

~~**803.3.4.1 Temperature reset for air systems.** Controls shall be provided that have the capability to automatically reset the supply air in response to measured parameters representative of building loads or by outside air temperature. Temperature shall be capable of being reset by at least 25% of the design supply air to room air temperature difference.~~

Renumber following Sections.**Add Section 803.3.6 as follows:**

803.3.6 Exhaust Air Energy Recovery. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2400 L/s) or greater and have a minimum outside air supply of 70% or greater of the design supply air quantity shall have an energy recovery system with at least 50% recovery effectiveness.

Exceptions :

- 1) Systems exhausting toxic, flammable, paint or corrosive fumes or dust.
- 2) Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96.
- 3) Where the largest exhaust source is less than 75% of the design outdoor airflow.
- 4) Systems requiring dehumidification that employ series-style energy recovery coils wrapped around the cooling coil.

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- 5) Systems employing CO₂ control where ventilation rates are allowed to vary with load going below maximum ventilation design loads.

Renumber Sections 803.3.6, 803.3.7 and 803.3.8 to 803.3.7, 803.3.8 and 803.3.9.

Add Section 803.3.7 as follows:

803.3.7 Exhaust Hoods

803.3.7.1 Kitchen Hoods. Individual kitchen exhaust hoods larger than 5000 cfm shall be provided with makeup air sized for at least 50% of exhaust air volume that is (a) unheated or heated to no more than 60°F and (b) uncooled or cooled without the use of mechanical cooling.

Exceptions to 803.3.7.1:

- (a) Where hoods are used to exhaust ventilation air that would otherwise exfiltrate or be exhausted by other fan systems.
- (b) Certified grease extractor hoods that require a face velocity no greater than 60 fpm.

803.3.7.2 Fume Hoods. Buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm shall include at least one of the following features:

- (a) Variable air volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50% or less of design values.
- (b) Direct makeup (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2°F below room set point, cooled to no cooler than 3°F above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
- (c) Heat recovery systems to precondition makeup air from fume hood exhaust in accordance with 803.3.6 (Exhaust Air Energy Recovery) without using any exception.

Renumber Sections 803.3.7, 803.3.8 and 803.3.9 to 803.3.8, 803.3.9 and 803.3.10.

Add section 803.3.11:

803.3.11 Fireplaces. Fireplaces (solid fuel type) shall be installed with tight fitting noncombustible fireplace doors to control infiltration losses in the construction type listed here:

- (a) New masonry fireplaces or fireplace units designed to allow an open burn.
- (b) Whenever a decorative appliance (ANSI Standard Z21.60 gas-log style unit) is installed in an existing vented solid fuel fireplace that is also required to have a permanent free opening.
- (c) Fireplace (solid fuel type) units shall be provided with a source of combustion air, ducted from the outdoors, of sufficient quantity to support combustion. This source shall be equipped with a damper capable of being fully closed.

Exception to 803.3.11:

- (a) Where demonstrated not to be a practical application.

804 – SERVICE WATER HEATING

Add Section 804.1.1 as follows:

804.1.1 Electrical water heating limitation. Electric service water heating units shall be limited to a maximum of 5KW total power input .

805 – LIGHTING SYSTEMS:

Add Section 805.1.1 as follows:

805.1.1 Lighting exemptions. Exceptions shall apply for the following:

- (a) lighting within residential living units
- (b) emergency lighting that is automatically off during the normal building operation
- (c) lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation,
- (d) decorative gas lighting systems.

Revise Section 805.2 as follows:

805.2 Lighting controls. Lighting systems shall be provided with controls as required in Sections 805.2.1, ~~and 805.2.2 and 805.2.3.~~

Renumber Section 805.2.2 to 805.2.3

Add new text as follows:

805.2.2 Additional controls. Each area that is required to have a manual control shall have additional controls that meet the requirements of Sections 805.2.2.1, 805.2.2.2 or 805.2.2.3.

Exceptions:

- 1. Areas that have only one luminaire.
- 2. Areas that are controlled by an occupant-sensing device.
- 3. Corridors, storerooms, restrooms, or public lobbies.

~~805.2.1.1~~ **805.2.2.1 Bi Level Switching.** Each area less than 250 ft² that is required to have a manual control shall also allow the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50 percent.

Exceptions:

- 1. Areas that have only one luminaire.
- 2. Areas that are controlled by an occupant-sensing device.
- 3. Corridors, storerooms, restrooms, or public lobbies.
- 4. Guest rooms.

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805.2.2.2 Automatic lighting shutoff. Spaces greater than 250 ft² in buildings larger than 5,000 ft² shall be equipped with an automatic control device to shut off lighting in those spaces. This automatic control device shall function on either:

1. A scheduled basis, using time-of-day, with an independent program schedule that controls the interior lighting in areas that do not exceed 25,000 ft² and are not more than one floor, or
2. An unscheduled basis by occupant intervention.

805.2.1.2 805.2.2.3 Guest rooms. Guest rooms in hotels, motels, boarding houses, or similar buildings shall have at least one master switch at the main entry door that controls all permanently wired lighting fixtures and switched receptacles, except those in the bathroom(s). Suites shall have a control meeting these requirements at the entry to each room or at the primary entry to the suite.

No change to remainder of 805.2

Add Section 805.4.1.5 Exit signs, as follows:

805.4.1.5 Exit signs . Internally illuminated exit signs shall be either light emitting diodes (LED) or electro-illuminescant.

Revise Section 805.5 as follows:

805.5 Exterior lighting. When the power for exterior lighting is supplied through the energy service to the building, all exterior lighting, other than low-voltage landscape lighting, shall have a source efficacy of at least 60 45 lumens per watt.

Exception: Where approved because of historical aesthetics, safety, signage, or emergency considerations

Add Section 805.5.1 and table 805.5.1 as follows:

805.5.1 Exterior Lighting Power Limits. Building exteriors shall follow lighting power limits as per table 805.5.1

Note: Appropriate exterior lighting designs including maximum exterior illuminance levels and sharp cut-off exterior lighting fixtures may be required by the City of Burlington or the Chittenden County Regional Planning Commission or the District Environmental Commission for Act 250 projects. The *Outdoor Lighting Manual for Local Municipalities* published by the Chittenden County Regional Planning Commission should be consulted for information on suitable exterior lighting systems.

TABLE 805.5.1
Lighting Power Limits for Building Exteriors

<u>Applications</u>	<u>Power Limits</u>
<u>Building entrance with canopy or free standing canopy</u>	<u>3 W/ft of canopied area</u>
<u>Building entrance without canopy</u>	<u>33 W/lin ft of door width</u>
<u>Building exit</u>	<u>20 W/lin ft of door width</u>
<u>Building facades</u>	<u>0.25 W/ft² of illuminated facade area</u>

Delete Section 806, Total Building Performance, in its entirety and replace with new section as follows:

806 – OTHER EQUIPMENT

806.1 Motors . All permanently wired electrical motors shall meet the requirements of 806.1.1

806.1.1 Mandatory Provisions – Electric Motors . Electric motors shall comply with the requirements of the Energy Policy Act of 1992 where applicable, as shown in Table 806.1. Motors that are not included in the scope of the Energy Policy Act have no performance requirements in this section.

806.2 Electric Power Distribution. Electrical distribution systems shall be designed for the efficient distribution of electrical energy from the service entrance to the point of use.

Exception to 806.2: Emergency Power Systems

806.2.1 Electrical metering. In all multi-family dwellings, each dwelling unit shall be separately metered.

Exception to 806.2.1: Publicly financed housing for the elderly with fuel heating systems, with centrally operated air conditioning system, or without air conditioning systems.

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806.2.2 Voltage Drop

802.2.2.1 Feeders . Feeder conductors shall be designed for a maximum voltage drop of 2% at full connected load.

806.2.2.2 Branch Circuits . Branch circuits conductors shall be designed for a maximum voltage drop of 3% at full connected load.

806.3 Transformers . Single phase and three phase dry-type distribution transformers shall be selected based on rating as described in 806.3.1 .

Exceptions:

- (a) all rectifier transformers and transformers designed for high harmonics autotransformers
- (b) non-distribution transformers such as UPS transformers
- (c) special impedance, regulation and harmonic transformers
- (d) sealed and non-ventilated transformers
- (e) retrofit transformers, machine tool transformers or welding transformers
- (f) grounding or testing transformers.
- (g) Where the loading on the subject transformer can be demonstrated to be such that a different transformer would consume less energy
- (h) Dry-type transformers below 15 kVa
- (i) Drive transformers, both AC and DC
- (j) Transformers with tap ranges greater than 15% or frequency other than 60 Hz

806.3.1 Dry-type Transformers . Dry-type transformers shall comply with the minimum efficiencies in Table 806.2 as tested in accordance with NEMA standard TP2

TABLE 806.1
MINIMUM NOMINAL EFFICIENCY FOR GENERAL PURPOSE MOTORS

	MINIMUM NOMINAL FULL-LOAD EFFICIENCY (%)					
	OPEN MOTORS			ENCLOSED MOTORS		
# OF POLES:	<u>2</u>	<u>4</u>	<u>6</u>	<u>2</u>	<u>4</u>	<u>6</u>
RPM	<u>3600</u>	<u>1800</u>	<u>1200</u>	<u>3600</u>	<u>1800</u>	<u>1200</u>
Motor Horsepower						
<u>1</u>	--	<u>82.5</u>	<u>80.0</u>	<u>75.5</u>	<u>82.5</u>	<u>80.0</u>
<u>1.5</u>	<u>82.5</u>	<u>84.0</u>	<u>84.0</u>	<u>82.5</u>	<u>84.0</u>	<u>85.5</u>
<u>2</u>	<u>84.0</u>	<u>84.0</u>	<u>85.5</u>	<u>84.0</u>	<u>84.0</u>	<u>86.5</u>
<u>3</u>	<u>84.0</u>	<u>86.5</u>	<u>86.5</u>	<u>85.5</u>	<u>87.5</u>	<u>87.5</u>
<u>5</u>	<u>85.5</u>	<u>87.5</u>	<u>87.5</u>	<u>87.5</u>	<u>87.5</u>	<u>87.5</u>
<u>7.5</u>	<u>87.5</u>	<u>88.5</u>	<u>88.5</u>	<u>88.5</u>	<u>89.5</u>	<u>89.5</u>
<u>10</u>	<u>88.5</u>	<u>89.5</u>	<u>90.2</u>	<u>89.5</u>	<u>89.5</u>	<u>89.5</u>
<u>15</u>	<u>89.5</u>	<u>91.0</u>	<u>90.2</u>	<u>90.2</u>	<u>91.0</u>	<u>90.2</u>
<u>20</u>	<u>90.2</u>	<u>91.0</u>	<u>91.0</u>	<u>90.2</u>	<u>91.0</u>	<u>90.2</u>
<u>25</u>	<u>91.0</u>	<u>91.7</u>	<u>91.7</u>	<u>91.0</u>	<u>92.4</u>	<u>91.7</u>
<u>30</u>	<u>91.0</u>	<u>92.4</u>	<u>92.4</u>	<u>91.0</u>	<u>92.4</u>	<u>91.7</u>
<u>40</u>	<u>91.7</u>	<u>93.0</u>	<u>93.0</u>	<u>91.7</u>	<u>93.0</u>	<u>93.0</u>
<u>50</u>	<u>92.4</u>	<u>93.0</u>	<u>93.0</u>	<u>92.4</u>	<u>93.0</u>	<u>93.0</u>
<u>60</u>	<u>93.0</u>	<u>93.6</u>	<u>93.6</u>	<u>93.0</u>	<u>93.6</u>	<u>93.6</u>
<u>75</u>	<u>93.0</u>	<u>94.1</u>	<u>93.6</u>	<u>93.0</u>	<u>94.1</u>	<u>93.6</u>
<u>100</u>	<u>93.0</u>	<u>94.1</u>	<u>94.1</u>	<u>93.6</u>	<u>94.5</u>	<u>94.1</u>
<u>125</u>	<u>93.6</u>	<u>94.5</u>	<u>94.1</u>	<u>94.5</u>	<u>94.5</u>	<u>94.1</u>
<u>150</u>	<u>93.6</u>	<u>95.0</u>	<u>94.5</u>	<u>94.5</u>	<u>95.0</u>	<u>95.0</u>
<u>200</u>	<u>94.5</u>	<u>99.5</u>	<u>94.5</u>	<u>95.0</u>	<u>95.0</u>	<u>95.0</u>

TABLE 806.2
NEMA Class 1 Efficiency Levels for Dry-Type Distribution Transformers

<u>Reference Condition</u>		<u>Temperature</u>		<u>% of Nameplate Load</u>	
<u>Low Voltage</u>		<u>75°C</u>		<u>35 %</u>	
<u>Medium Voltage</u>		<u>75°C</u>		<u>50 %</u>	
<u>kVA</u>	<u>Single Phase Efficiency</u>		<u>kVA</u>	<u>Three Phase Efficiency</u>	
	<u>Low Voltage</u>	<u>Medium Voltage</u>		<u>Low Voltage</u>	<u>Medium Voltage</u>
<u>15</u>	<u>97.7</u>	<u>97.6</u>	<u>15</u>	<u>97.0</u>	<u>96.8</u>
<u>25</u>	<u>98.0</u>	<u>97.7</u>	<u>30</u>	<u>97.5</u>	<u>97.3</u>
<u>37.5</u>	<u>98.2</u>	<u>98.1</u>	<u>45</u>	<u>97.7</u>	<u>97.6</u>
<u>50</u>	<u>98.3</u>	<u>98.2</u>	<u>75</u>	<u>98.0</u>	<u>97.9</u>
<u>75</u>	<u>98.5</u>	<u>98.4</u>	<u>112.5</u>	<u>98.2</u>	<u>98.1</u>
<u>100</u>	<u>98.6</u>	<u>98.5</u>	<u>150</u>	<u>98.3</u>	<u>98.2</u>
<u>167</u>	<u>98.7</u>	<u>98.7</u>	<u>225</u>	<u>98.5</u>	<u>98.4</u>
<u>250</u>	<u>98.8</u>	<u>98.8</u>	<u>300</u>	<u>98.6</u>	<u>98.5</u>
<u>333</u>	<u>98.9</u>	<u>98.9</u>	<u>500</u>	<u>98.7</u>	<u>98.7</u>
<u>500</u>	---	<u>99.0</u>	<u>750</u>	<u>98.8</u>	<u>98.8</u>
<u>667</u>	---	<u>99.0</u>	<u>1000</u>	<u>98.9</u>	<u>98.9</u>
<u>883</u>	---	<u>99.1</u>	<u>1500</u>	--	<u>99.0</u>
			<u>2000</u>	---	<u>99.0</u>
			<u>2500</u>	--	<u>99.1</u>

Chapter 9: Referenced Standards

Revise Chapter 9 as follows:

~~ASHRAE/IES-93~~ ASHRAE/IESNA--90.1-99

~~*Energy Code for Commercial and High-Rise Residential Buildings*~~ *Energy Standard for Buildings Except Low-Rise Residential Buildings*

Remaining text unchanged.

APENDIX A: Modified IECC 2000 Envelope Table for Vermont

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)

TABLE 802.2(34)
[AMENDED]

2001 Vermont Guidelines for Energy Efficient Commercial Construction - BUILDING ENVELOPE REQUIREMENTS			
WINDOW AND GLAZED DOOR AREA 10% OR LESS OF ABOVE-GRADE WALL AREA			
ELEMENT	CONDITION/VALUE		
<u>Slab or below-grade wall (R-value)</u>	R-10		
<u>Heated (radiant) slab</u>	R-10 UNDER SLAB, R-10 PERIMETER		
Windows and glass doors assemblies	SHGC		U-factor
PF < 0.25	0.46		0.47
$0.25 \leq \text{PF} < 0.50$	0.55		0.47
$\text{PF} \geq 0.50$ or north-orientated	0.64		0.47
Skylights			
<u>Skylight with Curb, Glass, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.68		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.60
<u>Skylight with Curb, Plastic, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.71		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.71		U _{all} - 0.60
<u>Skylight without Curb, All, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.49		U _{all} - 0.58
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.58
Roof assemblies (R-value)	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-38		R-19
Metal joist/truss	R-38		R-20
Concrete slab or deck	NA		R-19
Metal purlin with thermal block	R-30		R-20
Metal purlin without thermal block	X		R-20
Floors over outdoor air or unconditioned space	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-30		R-27
Metal joist/truss	R-30		R-24
Concrete slab or deck	NA		R-22
Above-grade walls (R-value)	No framing	Metal framing	Wood framing
<u>Framed</u>			
R-value cavity	NA	R-19	R-19
R-value continuous	NA	R-3	R-0
<u>CMU > 8 in. with integral insulation</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-0	R-0
<u>Other masonry walls</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-3	R-0
<u>Metal Buildings</u>			
	NA	R19	NA

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)

TABLE 802.2(34) [Continued]

2001 Vermont Guidelines for Energy Efficient Commercial Construction - BUILDING ENVELOPE REQUIREMENTS			
WINDOW AND GLAZED DOOR AREA OVER 10% BUT NOT GREATER THAN 25% OF ABOVE-GRADE WALL AREA			
ELEMENT	CONDITION/VALUE		
<u>Slab or below-grade wall (R-value)</u>	R-10		
Heated (radiant) slab	R-10 UNDER SLAB, R-10 PERIMETER		
Windows and glass doors assemblies	SHGC		U-factor
PF < 0.25	0.46		0.47
$0.25 \leq \text{PF} < 0.50$	0.55		0.47
$\text{PF} \geq 0.50$ or north-orientated	0.64		0.47
Skylights			
<u>Skylight with Curb, Glass, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.68		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.60
<u>Skylight with Curb, Plastic, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.71		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.71		U _{all} - 0.60
<u>Skylight without Curb, All, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.49		U _{all} - 0.58
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.58
Roof assemblies (R-value)	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-38		R-23
Metal joist/truss	R-38		R-24
Concrete slab or deck	NA		R-23
Metal purlin with thermal block	R-30		R-24
Metal purlin without thermal block	X		R-24
Floors over outdoor air or unconditioned space	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-30		R-27
Metal joist/truss	R-30		R-24
Concrete slab or deck	NA		R-22
Above-grade walls (R-value)	No framing	Metal framing	Wood framing
<u>Framed</u>			
R-value cavity	NA	R-19	R-19
R-value continuous	NA	R-3	R-0
<u>CMU > 8 in. with integral insulation</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-0	R-0
<u>Other masonry walls</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-3	R-0
<u>Metal Buildings</u>			
	NA	R19	NA

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)

TABLE 802.2(34) [Continued]

2001 Vermont Guidelines for Energy Efficient Commercial Construction - BUILDING ENVELOPE REQUIREMENTS			
WINDOW AND GLAZED DOOR AREA OVER 25% BUT NOT GREATER THAN 40% OF ABOVE-GRADE WALL AREA			
ELEMENT	CONDITION/VALUE		
<u>Slab or below-grade wall (R-value)</u>	R-10		
Heated (radiant) slab	R-10 UNDER SLAB, R-10 PERIMETER		
Windows and glass doors assemblies	SHGC		U-factor
PF < 0.25	0.36		0.40
$0.25 \leq \text{PF} < 0.50$	0.50		0.40
$\text{PF} \geq 0.50$ or north-orientated	0.64		0.40
Skylights			
<u>Skylight with Curb, Glass, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.68		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.60
<u>Skylight with Curb, Plastic, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.71		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.71		U _{all} - 0.60
<u>Skylight without Curb, All, % of Roof</u>			
0.0 - 2.0%	SHGC _{all} - 0.49		U _{all} - 0.58
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.58
Roof assemblies (R-value)	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-38		R-23
Metal joist/truss	R-38		R-24
Concrete slab or deck	NA		R-23
Metal purlin with thermal block	R-30		R-24
Metal purlin without thermal block	X		R-24
Floors over outdoor air or unconditioned space	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-30		R-27
Metal joist/truss	R-30		R-24
Concrete slab or deck	NA		R-22
Above-grade walls (R-value)	No framing	Metal framing	Wood framing
<u>Framed</u>			
R-value cavity	NA	R-19	R-19
R-value continuous	NA	R-3	R-0
<u>CMU > 8 in. with integral insulation</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-0	R-0
<u>Other masonry walls</u>			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-3	R-0
<u>Metal Buildings</u>			
	NA	R19	NA

AMENDMENTS TO INTERNATIONAL ENERGY CONSERVATION CODE 2000 (IECC 2000)

TABLE 802.2(34) [Continued]

2001 Vermont Guidelines for Energy Efficient Commercial Construction - BUILDING ENVELOPE REQUIREMENTS			
WINDOW AND GLAZED DOOR AREA OVER 40% BUT NOT GREATER THAN 50% OF ABOVE-GRADE WALL AREA			
ELEMENT	CONDITION/VALUE		
Slab or below-grade wall (R-value)	R-10		
Heated (radiant) slab	R-10 UNDER SLAB, R-10 PERIMETER		
Windows and glass doors assemblies	SHGC		U-factor
PF < 0.25	0.32		0.40
0.25 ≤ PF < 0.50	0.48		0.40
PF ≥ 0.50 or north-orientated	0.64		0.40
Skylights			
Skylight with Curb, Glass, % of Roof			
0.0 - 2.0%	SHGC _{all} - 0.68		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.60
Skylight with Curb, Plastic, % of Roof			
0.0 - 2.0%	SHGC _{all} - 0.71		U _{all} - 0.60
2.1 - 5.0%	SHGC _{all} - 0.71		U _{all} - 0.60
Skylight without Curb, All, % of Roof			
0.0 - 2.0%	SHGC _{all} - 0.49		U _{all} - 0.58
2.1 - 5.0%	SHGC _{all} - 0.49		U _{all} - 0.58
Roof assemblies (R-value)	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-38		R-23
Metal joist/truss	R-38		R-24
Concrete slab or deck	NA		R-23
Metal purlin with thermal block	R-30		R-24
Metal purlin without thermal block	X		R-24
Floors over outdoor air or unconditioned space	Insulation Between Framing		Continuous Insulation
All-wood joist/truss	R-30		R-27
Metal joist/truss	R-38		R-24
Concrete slab or deck	NA		R-22
Above-grade walls (R-value)	No framing	Metal framing	Wood framing
Framed			
R-value cavity	NA	R-19	R-19
R-value continuous	NA	R-13	R-3
CMU > 8 in. with integral insulation			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-0	R-0
Other masonry walls			
R-value cavity	NA	R-11	R-11
R-value continuous	R-5	R-3	R-0
Metal Buildings			
	NA	R19	NA

For SI 1 inch = 25.4 mm.

a. Values from attached Tables shall be used for the purpose of the completion of Tables 802.2(1) through 802.2(4), as applicable based on window & glazed door area

b. "NA" indicates the condition is not applicable.

c. An R-value of zero indicates no insulation is required.

d. "Any" indicates any available product will comply.

e. "X" indicates no complying option exists for this condition.

END OF AMENDMENTS